

REMARKS

Claims 1-5, 8-16 and 18-57 are pending, with claims 19-57 withdrawn from consideration. By this Amendment, no claims are cancelled, claim 1 is amended, and no new claims are added. Support for this Amendment can be found in the specification as originally filed, and no new matter is believed to be introduced.

**Claim Rejections – 35 U.S.C. § 103**

The December 20, 2010 Office Action rejected claims 1-5, 8, 9, 16 and 18 under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 4,888,316 to Gardner et al. and alternatively rejected under 35 U.S.C. § 103 as being unpatentable over Gardner et al. in view of U.S. Patent Publication US2006/0167119 to Leng et al. The March 23, 2011 Advisory Action maintained these rejections for the reasons of record in the December 20, 2010 Office Action. In response, Applicants have amended independent claim 1 to further clarify the presently claimed invention and respectfully traverse the rejections as a *prima facie* case of obviousness has not been established.

Independent claim 1 is directed to an impregnated and calcined Fischer-Tropsch (“F-T”) catalyst for use in a F-T synthesis reaction, the impregnated and calcined Fischer-Tropsch catalyst comprising cobalt supported on alumina, in which the impregnated and calcined Fischer-Tropsch catalyst average particle size is in the range 20 to 100  $\mu\text{m}$ , the specific surface area of the impregnated and calcined Fischer-Tropsch catalyst particles is greater than 120  $\text{m}^2/\text{g}$ , the average pore size of the impregnated and calcined Fischer-Tropsch catalyst is at least 90Å (9nm), the pore volume of the impregnated and calcined Fischer-Tropsch catalyst is at least 0.45

cm<sup>3</sup>/g, and the cobalt content of the impregnated and calcined Fischer-Tropsch catalyst is from 10 to 40% by weight.

The December 20, 2010 Office Action relied upon Gardner either alone, or in combination with Leng for the particle size limitation<sup>1</sup>, for each of the rejections of independent claim 1. “In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious.” MPEP 2141.02 (I) (emphasis in original) *citing* *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenk v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983). Further, “A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention.” MPEP 2141.03 (VI) *citing* *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 202 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). “It is [further] improper to combine references where the references teach away from their combination.” MPEP 2145(X)(D)(2) *citing* *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). When properly considered in their entirety (i.e., as a whole), not only does the Gardner reference teach away from the presently claimed impregnated and calcined F-T catalyst, but also the Gardner and Leng references teach away from their combination.

#### Gardner Teaches Away from F-T Catalysts, including the Claimed Invention

One of ordinary skill in the art will appreciate that catalysts are seldom, if ever, developed as a general purpose catalyst. The main reason for this being that a highly attractive feature of a catalyst for one particular reaction (such as F-T synthesis) or particular technical

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<sup>1</sup> The December 20, 2010 Office Action admitted that Gardner “does not explicitly teach an average catalyst particle size within the claimed range.” (December 20, 2010 O.A. at p. 3.)

environment (e.g., type of reactor and other process parameters) may be less favorable, irrelevant, or even detrimental in another context.

To this point, Gardner makes no mention of F-T reactions or of a syngas feed. Instead, Gardner is specifically directed towards a reconditioned “hydrotreating catalyst to be used in a process for hydrotreating hydrocarbon containing feed streams (oils) which contain metal impurities.” (Abstract.) Gardner teaches that platinum, palladium and other Group VIII noble metals and compounds thereof are essentially *absent* from the fresh catalyst composition, which after the fresh catalyst is spent comprises the underlying starting material for the reconditioned catalyst. (Col. 3, ll. 15-17.) Gardener also provides that for the reconditioned catalyst, “[s]uitable hydrocarbon containing feed streams include crude oils and fractions thereof, petroleum products, heavy oil extracts, coal pyrolyzates, liquefied coal products, products from tar sands, shale oil and shale oil products.” (Col. 5, ll. 63-67.) Gardner goes on to state that “[t]he catalyst composition of this invention is particularly suited for treating petroleum residua such as heavy topped crudes and hydrotreated heavy oil residua, which generally have an initial boiling point (measured under atmospheric pressure) in excess of about 400°F., preferably in excess of about 600°F., and contain about 5-1000 ppmw (parts by weight of metal per million parts of weight of hydrocarbon-containing feed) vanadium, about 3-500 ppmw nickel, about 0.5-7.0 weight-% sulfur, about 0.2-2.0 weight-% nitrogen and about 1-30 weight-% Ramsbottom carbon residue.” (Col. 5, l. 67 – Col. 6, l. 10.) From at least the foregoing, it is clear that the Gardner catalyst is directed to hydrocarbon conversion processes.

One of ordinary skill in the art will appreciate that in an F-T process the conversion of synthesis gas, which mainly comprises carbon monoxide and hydrogen, has much lower boiling

points than the “in excess of about 400°F., preferably in excess of about 600°F.,” taught and disclosed in Gardner. One of ordinary skill in the art will also appreciate that platinum, palladium and other Group VIII noble metals, which are specifically identified as being *absent* from the fresh catalyst composition in Gardner, which after being spent comprises the underlying starting material for the reconditioned catalyst, are commonly used as promoters in F-T processors. Further, one of ordinary skill in the art will appreciate that F-T catalysts are sensitive to poisoning by sulfur-containing compounds, and sensitivity of the catalyst to sulfur is greater for cobalt-based F-T catalysts than their iron counterparts, which is in stark contrast to the reconditioned catalyst of Gardner that is particularly suited for treating petroleum residua containing about 0.5-7.0 weight-% sulfur.

Additionally, Gardner teaches that the “[m]etal promoter weight percentages in the calcined catalyst composition generally are in the range of about 0.5 to about 10 weight-% metal (i.e., Mo or W or Ni or Co, or mixture of two or more of these metals), preferably about 2-6 weight-% metal.” (Col. 5, ll. 39-44.) In other words, Gardener teaches one of ordinary skill in the art that the catalyst for the hydrocarbon conversion process preferably contains about 2-6 weight-% metal, such as cobalt. In fact, Example I in Gardner teaches that the catalyst composition contains about 0.6 weight-% cobalt and 1.7 weight-% molybdenum. (Col. 8, ll. 55-57.) In stark contrast, the presently claimed impregnated and calcined F-T catalyst has a cobalt content from 10-40% by weight.

Accordingly, when properly considered in its entirety (i.e., as a whole), Gardner teaches away from an F-T process and F-T catalyst. It is unreasonable and error for the Examiner to assert that one of ordinary skill in the art would identify Gardner as a primary reference in the art

of F-T catalysts, particularly as the catalyst to modify to provide an impregnated and calcined F-T catalyst of the presently claimed invention. One of ordinary skill in the art, when properly considering Gardner in its entirety, would not look to Gardner with the purpose of modifying the particle size limitation, much less optimization of the particle size for an F-T catalyst. In other words, there is no reasonable basis for one of ordinary skill in the art to modify the Gardner catalyst directed at hydrocarbon conversion processes into an F-T catalyst as provided in the present invention. "Optimization" of the particle size limitation cannot go in the opposite direction taught by Gardner, other than being asserted upon improper hindsight based upon the teachings of Applicants' invention.

#### Gardner and Leng Teach Away from Their Combination

As discussed above, when considered in its entirety, there are at least three instances where Gardner teaches away from F-T catalysts. Instead, the Gardner catalyst is directed to a hydrotreating catalyst for hydrocarbon processing methods on oil feed streams. In fact, Gardner makes no mention of F-T reactions or of a syngas feed. In stark contrast, Leng is directed towards F-T reactions combined with hydrocracking or isomerisation processors that utilize a mixed particulate catalyst comprising a mixture of a particulate F-T catalyst and a particulate hydrocracking and/or isomerisation catalyst. (Abstract.) For example, Gardner teaches that platinum, palladium and other Group VIII noble metals and compounds thereof are essentially **absent** from the fresh catalyst composition, which after the fresh catalyst is spent comprises the underlying catalyst material of the reconditioned catalyst. (Col. 3, ll. 15-17.) In stark contrast, Leng teaches that "[p]romoters may be added to the catalyst and are well known in the Fischer-Tropsch catalyst art. Promoters can include ruthenium, platinum or palladium... Preferred

promoters are rhenium and hafnium.” (para. [0037].) Accordingly, one of ordinary skill in the art when properly considering Gardner and Leng in their entirety, would appreciate Gardner and Leng teaching away from each other. Thus, one of ordinary skill in the art would not modify the particle size of the catalyst in Gardner in view of the F-T catalyst in Leng. Thus, it was also error for the Examiner to conclude that it would be obvious to modify Gardner’s catalyst by employing a particle size as taught by Leng.

Reply to Examiner’s “Response to Arguments”

In the “Response to Arguments” section, the Examiner states Gardner’s catalyst can be employed in slurry-phase processes. (citing Col. 6, ll. 12-27.) This portion of Gardner cited by the Examiner specifically states “[t]he hydrotreating process can be carried out using a fixed catalyst bed (presently preferred) or a fluidized catalyst bed or a moving catalyst bed or an agitated slurry of the regenerated catalyst in the oil feed (hydrovisbreaking operation).” (Col. 6, ll. 23-27.) Gardner makes no mention of F-T reactions or of a syngas feed. Instead, in reference to “the oil feed,” Gardner states “[s]uitable hydrocarbon containing feed streams include crude oils and fractions thereof, petroleum products, heavy oil extracts, coal pyrolyzates, liquefied coal products, products from tar sands, shale oil and shale oil products.” (Col. 5, ll. 63-66.)

Further, the portion of Gardner cited by the Examiner and relied upon as the basis for F-T processes specifically states the hydrotreating process employing the active hydrotreating catalyst “produce[s] a hydrocarbon containing product having reduced levels of metals...and sulfur.” This portion of Gardner suggests the hydrotreating catalyst removes sulfur from the hydrocarbon-containing feed stream. Again, this portion of Gardner teaches away from an F-T process as one of ordinary skill in the art appreciates F-T catalysts are sensitive to poisoning by

sulfur-containing compounds, and sensitivity of the catalyst to sulfur is greater for cobalt-based F-T catalysts than their iron counterparts.

Thus, the portion of Gardner cited by the Examiner and relied upon as the basis for F-T processes, not only recites the catalyst being in intimate contact with the oil feed, which is in stark contrast to a syngas feed in a F-T process, but the hydrotreating process removes sulfur-containing compounds, which again are in stark contrast to F-T processes. Accordingly, the Examiner has erred in concluding that it would be obvious to adjust Gardner's catalyst particle size through routine experimentation as it relates to F-T catalysts, as Gardner clearly teaches away from F-T processes and catalysts, including the impregnated and calcined F-T catalyst of the presently claimed invention.

Still further, the Examiner admits that Gardner does not explicitly teach an average catalyst particle size within the claimed range of independent claim 1. Instead, the Examiner states "Gardner does teach the grinding of spent catalyst (to ~40-250 mesh (~425-58  $\mu$ m), implying that an appropriate fresh particle's size is either approximately that size or smaller, since the catalyst acquires impurities (e.g., 'coke,' etc.) and is thus enlarged during the fouling/use process. *See id.* at col. 2, ln. 47-56, and col. 4, ln. 1-4." (Dec. 20, 2010 O.A. at p. 3.) The Examiner's speculation regarding the fresh particle's size is flawed for numerous reasons.

First, the Examiner's position fails to consider Gardner in its entirety. Gardner discloses that step (a) involves grinding a substantially spent hydrotreating catalyst. If the particle size of the fresh catalyst used in Gardner was approximately the same size as the ground spent catalyst (40-250 mesh size) or smaller, then there would be no point in carrying out step (a) of the Gardner process, as this would be unnecessary because the spent catalyst composition would

already have the appropriate size for going directly to the mixing and shaping steps (b) and (c) of the process. Thus, it would be evident to one of ordinary skill in the art that the particle size of the fresh or spent catalyst composition used in Gardner must have a particle size substantially larger than 40 - 250 mesh size in order for step (a) of the Gardner process to serve any technical purpose.

Secondly, hydrotreating processes employing a hydrotreating catalyst composition are normally carried out in fixed bed reactors. This is indeed indicated as the preferred mode of operation in Gardner, requiring appreciably larger catalyst particle sizes than 40 - 250 mesh, as indicated by the size of the extrudates produced according to example 1 in Gardner, which have a size of 1/32 inch by 0.1 inch. Further support for this interpretation of Gardner can be found in the following statement from Gardner: "*Generally, the size of the thus shaped particles is such as to provide particles in subsequent heating step (d) of such size as to make them suitable for use in fixed catalyst beds, as is well known by those skilled in the art*". (Col. 4, ll. 39-43.) Although Gardner also mentions agitated slurry operation as well as fixed bed operation, it is most likely that such agitated slurry operations are carried out using catalyst particles larger than those included in the 40 - 250 mesh range. As step (a) is an obligatory step of the Gardner process (the option of by-passing step (a) is not discussed in Gardner), the only reasonable interpretation of Gardner is that even though agitated slurry operation is mentioned as an option, the particle size of the Gardner fresh and spent catalyst will still have a larger particle size than 40 - 250 mesh.

Further, Gardner discloses the reconditioned catalysts being intended for use in hydrotreating operations and specifically states:

The pasty mixture obtained in step (b) can be shaped in step (c) by any conventional shaping process, such as extrusion through at least one die (round or square or trilobal



and the like) and subsequent cutting the extruded strand(s), or by pelletizing (using a disc pelletizer or a press or any other conventional pelletizing equipment), and the like. Generally, the size of the thus shaped particles is such as to provide particles in subsequent heating step (d) of such size as to make then suitable for use in fixed catalyst beds, as is well known by those skilled in the art.

(Col. 4, ln. 33-43.) This passage suggests that the appropriate size of catalysts in hydrotreating operations is larger, not smaller, than the ground size of the spent catalyst.

The Examiner's conclusory argument regarding the catalyst particles size fails to appreciate the hydrotreating catalyst technology and is merely conclusory without a sufficient underlying basis. Also, as discussed above, the Examiner's basis for adjusting the size of Gardner's particles to an appropriate size for an F-T catalyst is in error. Accordingly, based upon the foregoing and contrary to the Examiner's arguments, Gardner actually teaches away from an F-T synthesis reaction catalyst, and the assertion that the catalysts in Gardner would be suitable for an F-T synthesis would render the Gardner reference unsatisfactory for its intended purpose, which is for hydrocarbon processing of oil feed streams.

### **Conclusion**

For at least the foregoing reasons, a *prima facie* case of obviousness has not been established, as the cited references, individually or in combination, are not suitably modified or combined to teach or suggest all of the features included in independent claim 1. If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending therefrom is non-obvious. *In re Fine*, 837, F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, Applicants are not presenting additional arguments with respect to the patentability of the dependent claims, although Applicants do not acquiesce to any of the rejections and reserve the right to raise additional arguments with respect to the patentability of such claims. As all

remaining pending claims depend directly or indirectly from one of the subject claims, Applicants respectfully request that the rejections under § 103 be withdrawn. Also, because a *prima facie* case of obviousness has not been established, Applicants do not comment further here on the suitability of combining or modifying the cited references. Thus, Applicants respectfully request reconsideration and withdrawal of these rejections.

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,



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